REMARKS

Claims 2-22, 24, and 26-43 are now pending in the application with claims 2-19, 24, and 26-41 having been withdrawn. Claims 20-22, 42, and 43 are currently amended. Claims 1, 23, and 25 are cancelled. No claims are newly added by this amendment. Dependent Claims 20-22 have been rewritten into independent form by incorporating the limitation recited in independent Claim 1. Dependent Claims 42-43 have been rewritten into independent form by incorporating the limitation recited in independent Claim 25. Claims 21 and 43 have also been amended (see the recitation of the optical carrier frequency detection unit) based on, for example, paragraph [0151] of the specification. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

ELECTION/RESTRICTIONS

Applicants elected Species 12 readable on claims 1, 20-25, 42, and 43 in a response filed April 30, 2009. Applicants confirm that they agreed to withdraw claim 24 per an interview between Applicants' representative and the Examiner on June 17, 2009. Therefore, Applicants elect claims 1, 20-23, 25, 42, and 43 without prejudice and reserve the right to prosecute the remaining non-elected claims at a later date.

REJECTION UNDER 35 U.S.C. § 112

Claim 20 stands rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point and distinctly claim the subject matter which Applicants regard as the invention. This rejection is respectfully traversed.

Claim 20 has been amended based on, for example, FIG. 28 and paragraphs [0144] and [0145] of the specification. Specifically, the phrase "an output of the infinitesimal-modulated signal oscillation circuit" in lines 3-4 of previous Claim 20 should refer to the phrase "a first low-frequency signal at frequency f1" (see the recitation of "a low-frequency signal generation circuit" in previous Claim 1).

Please note that, as will be explained later, the limitation recited in previous Claim 1 has been incorporated into Claim 20. Therefore, the recitation of the last paragraph of previous Claim 20 has been combined with the recitations of the Mach-Zehnder interferometer, the low-frequency signal generation, the control circuit, and the driver circuit, which are recited in previous Claim 1.

Since Claim 42 includes language similar to that in Claim 20, Claim 42 has been amended in the same manner as Claim 20.

REJECTION UNDER 35 U.S.C. § 103

Claims 1, 21, 25, and 43 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Tomioka (JP 2003-309520; "Tomioka") in view of Kim (U.S. Pat. No. 6,271,959; "Kim"). This rejection is respectfully traversed.

Regarding the optical carrier frequency detection unit recited in Claims 21 and 43, the Examiner points out a photodetector 25 and a synchronous detector 24 shown in FIG. 7 of Tomioka (page 9, lines 8-17, of the Office Action). Please note that the English machine-translation of Tomioka recites that reference numeral 25 denotes an electric eye, but it actually denotes a photodetector.

However, the optical carrier frequency detection unit recited in Claims 21 and 43 detects, from received signal light detected by the balanced detection circuit, a relative position between an optical carrier frequency and an optical frequency characteristic of the Mach-Zehnder interferometer.

To this end, in the nineteenth embodiment of the present application, which corresponds to Claims 21 and 43, an optical carrier frequency detection circuit 295 determines the position of a carrier from a modulation signal without a carrier (for example, the modulation signal is scanned using a Fabry-Perot resonator to find two minima in the optical spectrum, and the optical carrier frequency is taken to be the midpoint between the frequencies at these two minima (see paragraph [0151] of the specification). In addition, as explained above, Claims 21 and 43 have been amended so as to include such a feature of the nineteenth embodiment of the present application.

Tomioka fails to disclose or suggest such a structure. Therefore, unlike Claims 21 and 43, it is impossible for the photodetector 25 and the synchronous detector 24 of Tomioka to detect a relative position between an optical carrier frequency and an optical frequency characteristic of a Mach-Zehnder interferometer.

According to Claims 21 and 43, the position of an optical carrier can be determined from a modulation signal having no carrier, and the peak or the bottom of the optical frequency characteristic of the Mach-Zehnder interferometer can be matched with the optical carrier frequency, even when the optical modulated signal spectrum is asymmetric. Such an advantageous effect cannot be obtained from the structure of Tomioka.

Regarding the offset setting circuit recited in Claims 21 and 43, the Examiner points out paragraph [0042] of Tomioka and asserts that "synchronous detector 24 and filter 26 also serves as the offset setting circuit, which outputs offset signal to the control circuit 27.... the feedback control loop shown in Figure 7 controls the center wavelength of the light interferometer within the optical receiver 8, the synchronous detector 24 compares the signal from the detector 25 and the signal from the oscillator 23, and then an offset is obtained, and the offset is sent to the mixer 27, and then, a feedback error signal is formed in the control circuit 27" (page 9, line 17, to page 10, line 2, of the Office Action).

However, FIG. 7 of Tomioka merely suggests a feedback error signal. Specifically, the synchronous detector 24 and the filter 26 shown in FIG. 7 of Tomioka merely supply a feedback error signal through a feedback circuit. The synchronous detector 24 and the filter 26 of Tomioka do not have a function of providing an offset to such a feedback error signal. Therefore, Applicants believe that the foregoing Examiner's assertions are improper.

Regarding the limitation recited in the last paragraph of Claims 21 and 43 (i.e., "a value of the offset of the offset setting circuit is adjusted such that the position of the optical carrier frequency matches a peak position or bottom position of the optical frequency characteristic of the Mach-Zehnder interferometer"), the Examiner points out FIG. 6, FIG. 9, and paragraph [0035] of Tomioka (page 10, second paragraph, of the Office Action).

However, the structure of Tomioka may merely be able to stabilize the optical frequency characteristic of a Mach-Zehnder interferometer 9 to a peak or a bottom of

the average intensity of light output from the Mach-Zehnder interferometer 9. This does not mean that the position of an optical carrier frequency matches a peak position or a bottom position of the optical frequency characteristic of a Mach-Zehnder interferometer. Tomioka does not disclose or suggest the foregoing limitation of Claims 21 and 43. Therefore, it is respectfully submitted that Claims 21 and 43 define patentable subject matter over the combination of Tomioka and Kim. Accordingly, Applicants respectfully request reconsideration and withdrawal of this rejection. Applicants have cancelled Claims 1 and 25, rendering the rejection moot as to these claims.

Claims 20 and 42 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Tomioka and Kim as applied to claim 1 and 25 above, and further in view of Kobayashi (JP 2004-037647; "Kobayashi") and Nishimoto (U.S. Pat. No. 5,359,449; "Nishimoto"). This rejection is respectfully traversed.

Regarding the Mach-Zehnder interferometer recited in Claims 20 and 42, the Examiner cites Kobayashi and Nishimoto. However, Kobayashi and Nishimoto are merely directed to the structure in which a Mach-Zehnder interferometer is provided in an optical transmitter. In contrast, in Claims 20 and 42, the Mach-Zehnder interferometer is provided in an optical receiver.

Regarding the specific feature of the invention as recited in Claims 20 and 42 (hereinafter referred to as "the present invention"), the Examiner points out FIG. 1 and FIG. 7 of Kobayashi (page 11, first paragraph, of the Office Action). However, the structures shown in FIG. 1 and FIG. 7 of Kobayashi are fundamentally different from the structure of the present invention.

In Kobayashi, the MZ optical modulator 3 is a symmetric Mach-Zehnder interferometer. Specifically, Kobayashi does not mention to which arm a modulated signal is to be applied (see, for example, paragraph [0004]). Therefore, one having ordinary skill in the art understands that Kobayashi assumes that a symmetric Mach-Zehnder interferometer is used as the MZ optical modulator 3. Moreover, the MZ optical modulator 3 is provided with phase adjustment terminals which utilize an electrooptic effect. Specifically, Kobayashi recites that "... the most general external modulator is a Mach-Zehnder optical modulator (hereinafter referred to as "MZ modulator") which utilizes an electrooptic effect of a dielectric waveguide made of a material such as lithium niobate ($LiNbO_3$)" (see paragraph [0003]). Therefore, one having ordinary skill in the art understands that Kobayashi assumes that a Mach-Zehnder optical modulator which utilizes an electrooptic effect is used as the MZ optical modulator 3. Furthermore, a modulating signal is superposed on a low frequency signal. Specifically, a superposing circuit 13 superposes a signal output from a driver circuit 4, which amplifies a sine wave signal for driving the MZ optical modulator 3 which is input through an input signal terminal 1, on a dither signal output from a dither signal source 12 (paragraphs [0041] to [0042]).

In contrast, in the present invention, the Mach-Zehnder interferometer is an asymmetric Mach-Zehnder interferometer, the Mach-Zehnder interferometer is provided with phase adjustment terminals which employ a thermooptic effect (e.g., paragraph [0146] of the specification), and the first low-frequency signal is directly applied to one of the phase adjustment terminals of the Mach-Zehnder interferometer (i.e., a modulating signal is not superposed on the first low-frequency signal).

In this way, the structures of FIG. 1 and FIG. 7 of Kobayashi are essentially different from the structure of the present invention (in particular, regarding the superposition technique of a low-frequency signal).

In addition, owing to a difference in employed physical phenomenon (i.e., an electrooptic effect or a thermooptic effect), the present invention provides a distinctive advantageous effect that cannot be obtained from FIG. 1 or FIG. 7 of Kobayashi. Specifically, in FIG. 1 and FIG. 7 of Kobayashi, the operating characteristics are theoretically the same, independent of the arm (phase adjustment terminal) of the MZ optical modulator 3 to which a feedback error signal is applied. In contrast, since the present invention uses phase adjustment terminals which employ a thermooptic effect, there is a non-linear relationship between the driving voltage/the driving current and a change in optical phase. As a result, the operating characteristics are drastically changed depending on whether a feedback error signal is applied to one of the two phase adjustment terminals of the Mach-Zehnder interferometer or to the other of the two phase adjustment terminals of the Mach-Zehnder interferometer.

Therefore, it is respectfully submitted that Claims 20 and 42 define patentable subject matter over the combination of cited references. Accordingly, Applicants respectfully request reconsideration and withdrawal of this rejection.

Claim 23 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishizawa et al. ("10 Gb/s Optical DPSK Packet Receiver Proof Against Large Power Fluctuations," IEEE Photonics Technology Letter, Vol. 11, No. 6, June 1999, pp. 733-735; "Nishizawa") in view of Hoshida (U.S. Pub. No. 2005/0047780; "Hoshida") and

Leibrich et al. ("CF-RZ-DPSK for Suppression of XPM on Dispersion-Managed Long-Haul Optical WDM Transmission on Standard Single-Mode Fiber," IEEE Photonics Technology Letter, Vol. 14, No. 2, February 2002, pp. 155-157; "Leibrich"). This rejection is respectfully traversed. Applicants have cancelled Claim 23, thereby rendering this rejection moot.

ALLOWABLE SUBJECT MATTER

The Examiner states that claim 22 would be allowable if rewritten in independent form. Accordingly, Applicant has amended claim 22 to include the limitations of the base claim and any intervening claims. Therefore, claim 22 should now be in condition for allowance.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action and the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested.

If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

Dated: September 18, 2009

By: /Gregory A. Stobbs/_____
Gregory A. Stobbs
Reg. No. 28,764

HARNESS, DICKEY & PIERCE, P.L.C.
P.O. Box 828
Bloomfield Hills, Michigan 48303
(248) 641-1600

GAS/dec

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